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**ENHANCING PRODUCTIVITY THROUGH
FEEDBACK AND JOB DESIGN**

By

Robert D. Pritchard
Raymond V. Montagno
John R. Moore
Purdue Research Foundation
West Lafayette, Indiana 47906



**OCCUPATION AND MANPOWER RESEARCH DIVISION
Brooks Air Force Base, Texas 78235**

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This technical report has been reviewed and is approved for publication.

RAYMOND E. CHRISTAL, Technical Director
Occupation and Manpower Research Division

RONALD W. TERRY Colonel, USAF
Commander

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This research represents a study in a program to investigate potential sources of the intrinsic motivation of Air Force personnel. The first step in this process was an attempt to identify and list a number of sources of intrinsic motivation. From this list, feedback and job design were selected as sources that held promise for use in Air Force type settings. This report describes an attempt to manipulate several dimensions of feedback and the degree to which a person did a complete unit of work. A job simulation was employed to experimentally test the variables finally selected. The criteria for the task used in the simulation were that it have generalizability to the Air Force and that it possess acceptable face validity for the subjects participating in the study. The task used in this study involved the processing of purchase requisitions and was designed so that subjects believed they were working on a real job and so		

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that there were distinct quantity and quality dimensions that could be measured. The results of the study indicated that feedback has great potential for improving productivity. However, different types of feedback had markedly different effects. The best type of feedback in this study was Impersonal, High Specificity, Individual feedback in either the Public or Private format. This combination of feedback resulted in a 26% increase in quantity and a 27% decrease in errors.

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PREFACE

The research reported is related to ongoing research in the Occupation and Manpower Research Division of the Air Force Human Resources Laboratory. Capt John O. Edwards, Jr. was the monitor from this Division. The research was conducted under contract F33615-77-C-0026 with the Purdue Research Foundation. Dr. Pritchard is now at the Department of Psychology, University of Houston, Houston, Texas. The research was completed under project 2313, Human Resources, task 2313T1, Job Requirements and Personnel Utilization, Work Unit 2313T107, Improved Productivity Through Use of Intrinsic Rewards.

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ENHANCING PRODUCTIVITY THROUGH FEEDBACK AND JOB DESIGN

I. INTRODUCTION

Enhancing productivity is a central concern in today's Air Force. In an era of shrinking manpower resources, it is more important than ever for each person in the Air Force to perform at as high a level as possible. One major approach of enhancing productivity has been to attempt to increase the person's motivation on the job. The logic here is that once the best people have been selected from those available and have been trained to perform the job effectively, the primary mechanism left to increase an individual's effectiveness is through motivation.

Approaches to increasing motivation have traditionally been divided into two major types. The first is extrinsic motivation techniques which make valued, organizationally controlled rewards contingent on effective performance. Examples of such techniques would be piece rate pay systems, bonuses for high performance, and special forms of formal recognition for high performance. While all would agree that extrinsic rewards are necessary for any job, trying to increase productivity through increasing performance—contingent, extrinsic rewards has its problems. Such programs are difficult to administer, and to be really effective, the rewards must be fairly large; thus making such programs expensive (Pritchard, DeLeo, & VonBergen, 1974).

The second major approach to increasing motivation is through intrinsic techniques. The goal here is to structure the job so that the worker experiences some sort of positive affect when he or she performs well and negative affect when he or she performs poorly. One example of this positive affect would be a feeling of personal accomplishment for a job well done. If jobs can be structured so that workers feel personal accomplishment from doing a good job and a personal dissatisfaction when they do a poor job, several benefits accrue. First, people reward themselves; that is, the basic source of motivation is internal rather than external. Second, the motivation so produced is more permanent and does not require an elaborate externally administered program. Finally, from a philosophical point of view it seems more appropriate for people to perform well because they are involved with the mission of the organization rather than solely for the external rewards available.

Unfortunately, however, while intrinsic motivation techniques have great promise for enhancing productivity, relatively little is known about them. It is only in the last 10 years or so that behavioral scientists have begun any really systematic study of this area. This real potential of intrinsic motivation techniques for impacting productivity coupled with our lack of knowledge about them led to the current research program, of which this report forms a part.

Plan of the Research

The overall plan of the research consisted of four major phases. The first was to identify the potential determinants of intrinsic motivation, that is, from an examination of existing literature to isolate those variables that appear to have promise as factors related to intrinsic motivation. This search led to identification of the following variables (Pritchard & Montagno, 1978):

1. Feelings of personal control over the task.
2. Feelings of competence at doing the task.
3. Contingent extrinsic rewards. (Negatively related)
4. Degree of variety in the skills required to do the task.
5. Degree to which the task required the use of valued abilities.
6. Degree to which the person identified with the task.
7. Degree to which the person does a complete unit of the task.

8. Perceived significance of the task.
9. Degree of autonomy on the task (related to #1).
10. Adequacy of performance feedback.
11. Higher order need strength.
12. Work values.
13. Cultural influences.
14. Optimal arousal level.

The second phase of the research was to explore some of these variables in a controlled setting to begin to assess their suitability for eventual field application. Results of these efforts are described in Pritchard and Montagno (1978) and Fisher and Pritchard, (1978).

The third phase of the research effort, which is described by this report, attempted to isolate those variables which could be implemented in an operational Air Force environment and test a fairly large number of different possible applications in a controlled, yet realistic setting. The final phase of the project will be to perform tests, in an actual operational Air Force setting, of those techniques identified by the work done to date as having the best potential for enhancing productivity. In the present research, once the potential determinants of intrinsic motivation had been identified, and some preliminary laboratory work had been completed, it was necessary to select a subset of these potential determinants for more careful study. The primary criteria used in making this selection were (a) potential for ultimate use in a field setting, (b) feasibility of testing in the work simulation setting that was to be used for the present research, and (c) "quality and quantity" of previous literature available. With these criteria in mind, two major areas were selected for the present study: performance feedback and job scope (degree to which a person does a complete unit of the task). Before discussing the specific way in which these variables were dealt with in the study, it is appropriate to explore the literature in these areas.

Review of the Relevant Literature

Feedback

Feedback has long been recognized as a key element in learning, based on a number of assumptions about the motivational, learning, and reward properties of feedback (Ammons, 1956; Annett, 1969; Thorndike, 1927). As a result, a considerable body of research on feedback has accumulated over the years. (See Ammons, 1956; and Ilgen, Fisher, and Taylor, 1977, for reviews of this literature.) Unfortunately, as Ilgen and his colleagues point out, despite this plethora of research, not much is known about feedback as a psychological process. This problem arises because of the rather simplistic approach used in applying the feedback variable in many laboratory experiments. The result is that the literature is filled with many studies dealing with only a single dimension of feedback. Some examples of the more popular dimensions looked at are immediate vs. delayed feedback (Beeson, 1973; Christian, 1972; Robinson & Kuip, 1970; Sassenwrath & Younge, 1969), knowledge of right vs. wrong responses (Longstreth 1970; Merrill, 1970; Wike, 1970), verbal vs. nonverbal (Lair & Smith, 1970; Simpson, 1972), personal vs. impersonal (Weidner, 1968), accurate vs. inaccurate (Griswold, 1970), information content (Berman, Fraser, & Theious, 1970), and frequency (Ivancevich, Donnelly, & Lyon, 1970).

Feedback has recently come to the attention of industrial/organizational psychologists from two directions. The first of these is the perennial problem faced by organizations in the area of performance appraisal. McCall and DeVries (1976) point out that managers are aware that feedback is necessary for improving performance of employees. Managers are often reluctant, however, to give performance appraisal feedback because of a number of contextual characteristics that can be a source of conflict between supervisors and subordinates. The authors cite as an example the fact that performance appraisal is intended to be on the individual level, yet the individual's performance is often hopelessly intertwined in a group performance. McCall and DeVries list a set of characteristics that describe what some would consider to be

the contemporary "ideal" performance appraisal system. Among these characteristics are objectivity, participation, and frequency. Leskovec (1967) would add to this list a specificity dimension. Porter and Lawler (1968), working from the expectancy-valence model, attempt to explain why feedback should have an effect in organizational settings. They argue that feedback serves the role of establishing a link between effort and performance, and between performance and rewards. To the extent that feedback performs this function, it will be effective.

The second route by which feedback has gained attention is the work done on the motivational aspects of job design. Basing their work on Turner and Lawrence (1965), Hackman and Oldham (1975) developed a list of core job dimensions which should influence the motivating potential of a job. One of these core dimensions was feedback. Hackman and Oldham (1975) include feedback as one of the key elements in their instrument, the Job Diagnostic Survey (JDS). For the purposes of the JDS, feedback is divided into two categories: feedback from the job itself and feedback from agents (i.e., people). Feedback from the job is defined as the degree to which performing a particular job results in the job incumbent is obtaining direct and clear information about the effectiveness of his or her own performance. Feedback from agents is information received from supervisors or coworkers (Hackman & Oldham, 1975). Hackman and Oldham further theorize that the presence of feedback in a job will lead to what they call a critical psychological state, namely, knowledge of results (KR). The distinguishing characteristic of the KR state is that the worker has continual knowledge of his or her performance.

Hackman and Lawler (1971) propose that regardless of what other characteristics a job might have, if there is no way for the individual to get feedback, he or she will be unable to experience higher order satisfaction. Hackman and Lawler (1971) in an early evaluation of this model had some difficulty identifying the feedback content of jobs. They discovered in their analysis that there was considerable lack of inter-rater agreement as to the amount of feedback various jobs actually contained. Four rating procedures were used (employees, supervisors, researchers, and the Turner and Lawrence classification) and no significant correlations were found among them. The results of their study did show, however, that feedback was related to employee reactions to his or her job.

Payne and Hauty (1955) identified what they referred to as the motivational and incentive functions of feedback. In most organizational settings, the major concern is with the motivational facet. In other words, the concern is for altering the effort level in response to feedback information (Porter & Lawler, 1968); this assumes that no more learning is required to adequately perform the task. Locke, Cartledge, and Koepfel (1968) make a similar distinction. They propose that when no more learning occurs or when the feedback contains summary information only, the motivational process of feedback is in operation. They further contend that knowledge of results is motivational only to the extent that it facilitates the setting of goals. This implies that the feedback must contain information about standards or past performance.

Annett (1969) has proposed that feedback is a multidimensional concept and that simple interpretation of feedback as a facilitator of learning or an enhancer of motivation may be unjustified. He proposes that the effects of feedback depend on two factors. First, the nature of the information must be considered. Issues relevant here would be the various sources of feedback and methods of presentation. The second factor Annett considers important is the use made of the feedback information. The implication here is that any given episode of feedback may have a number of purposes, only one of which may be motivation.

A second problem in trying to isolate the issue of motivation is that of the narrow interpretation of learning. It would appear that learning in organizational settings goes beyond merely mastering a set of tasks. It is conceivable that at any given point in time, a particular employee may be undecided about the particular task in which to be engaged. This implies that the employee's role is dynamic and the selection of tasks is a constant learning process significantly influenced by feedback.

There have been a number of attempts, recently, to arrive at some convergence on the meaning of feedback. Greller and Herold (1975), for example, have studied the "source" dimension of feedback. Using a diverse sample of workers, they established five levels of the source dimension: the company, the

supervisor, the coworkers, the task, and the worker's own feelings and ideas. Their results showed that people most often used sources close to themselves for feedback. That is, one's own feelings and the task were the most common sources of feedback. It should be noted that the categories proposed by Hackman and Oldham (1975), namely the task itself and agents, could be looked at as summary headings for the Greller and Herold categories.

Ilgen, Fisher, and Taylor (1977) have also selected "source" of feedback as an important dimension. In addition, they propose that every external source varies in two important characteristics: credibility and power. They argue that the higher a source rates on these two factors, the more positive will be the effect of feedback. Ilgen and his associates also propose that the notion of separate feedback from the task and from the self, while theoretically possible, is probably unlikely in organizational settings.

Ilgen, Fisher, and Taylor (1977), in addition, have derived two other important dimensions of feedback. One of these is a qualitative dimension. This dimension reflects feedback characteristics such as immediacy of feedback, time delay, individual or group, and so on. The final dimension proposed by Ilgen, *et al.* is purposefulness. This refers to the fact that an agent usually has some motive for presenting feedback to an employee.

Greller (1975) noted some of the problems with using simple dichotomies on single dimensions of feedback. He then developed a taxonomy of feedback containing four dimensions. These include consequences from agents, expressions from agents, task feedback, and internal comparisons. The internal comparisons dimension reflects the idea that individuals observe others on the same job as themselves and then make internal comparisons. In addition to these four categories, Greller argues that the evaluative nature of the information presented is important, that is, each of these dimensions can vary along a positive-negative continuum.

In a study designed to test this model, Greller (1975) found partial support for his hypothesis. One discrepant finding was that positive and negative feedback were not simple opposites. He concluded that individuals will select the most favorable information from feedback in order to develop the most positive image of themselves under the given condition. One extension of Greller's conclusion is that, to the extent self-enhancement leads to feelings of competence, there could be increases in intrinsic motivation (Deci, 1971).

In another attempt at developing a meaningful taxonomy of feedback dimensions, Greller and Herold (1977) performed a factor analysis on a questionnaire of 50 feedback items. The result was a five-factor solution: Factor I – negative feedback, regardless of source; Factor II – positive, from above; Factor III – positive from nonhierarchical others; Factor IV – internal criteria; and Factor V – work flow feedback. Two overall dimensions that clearly stand out from these data are source and positive-negative.

It is clear from the preceding review that the concept of feedback, while widely recognized as important, lacks precise definition. Feedback is obviously a multidimensional variable. The attempts at dimensionalization (Greller & Herold, 1977; Hackman & Oldham, 1975; Ilgen, Fisher, & Taylor, 1977) previously reviewed, are definite steps in the right direction. One problem with the past approaches, however, is that the dimensions derived appear to be rather limited. Attempts at parsimony, before any clear understanding of a concept is obtained, seem premature.

The approach of the present authors is to identify as many dimensions of feedback as possible, and then manipulate them under experimental conditions, to determine their contributions to employee responses to the job. The attempt at generating a complete taxonomy of these dimensions (Pritchard & Montagno, 1978), involved two steps. First, the previous literature on feedback was reviewed, and the various dimensions formulated in other research were compiled. Second, intuitive analysis of the feedback construct was performed, and any gaps that appeared in the taxonomy were filled in.

The result of this effort is a list of 14 dimensions that appear to cover most of the possible variations that can have relevance in a feedback situation. While it is acknowledged that in some instances there is overlap between dimensions, it is felt that each has its own key elements and should be defined separately.

Feedback Dimensions

1. *Positive vs. Negative.* This dimension has three permutations: positive alone, negative alone, or positive and negative presented together. This type of feedback deals directly with the correctness of the behavior of interest. If the behavior is correct, positive feedback is given. If it is incorrect, negative feedback is given. If we are dealing with positive alone or negative alone, then feedback speaks only to the correct or incorrect behavior, not both.
2. *Timing of Feedback.* This dimension refers to the time that elapses between the performance of a task and the presentation of feedback. This elapsed time might vary from a long span of months or years to a situation where feedback is available during, and immediately after, performance.
3. *Specificity.* Variation along this dimension concerns the molecularity of the behaviors on which the feedback is given. The extremes of specificity would range from a single evaluation of a person's total role, to feedback on the smallest task-relevant act in which the person engages. Other meaningful points along this continuum might be the various subproducts or major products the individual produces.
4. *Evaluative – Nonevaluative.* Evaluative feedback is feedback given by some powerful Other in the organization and clearly implies that the powerful Other has evaluated the performance of the person. Nonevaluative feedback does not include this formalized evaluation by another person, but rather would typically come from mechanical sources.
5. *Absolute – Comparative.* Absolute feedback is information only about a person's own performance. Under comparative conditions, individuals would know their own performance as well as how this level of performance compares with reference to some other group, such as their own work group.
6. *Internal – External.* External feedback is information which comes from a source external to the performer. This source could be another person or some mechanical device (e.g., a counter). Internal feedback refers to information which is based on the person's own experience with the task. Proprioceptive or kinesthetic feedback would be internal feedback.
7. *Personal – Impersonal.* This dimension is concerned with the level of personal contact between the performer and the source of feedback. Face-to-face oral feedback from one's supervisor would be highly personal, while a self-obtained computer printout outlining performance would be highly impersonal.
8. *Power of Source.* Power here is defined in terms of the source's ability to control the individual's rewards. A high-power source would control pay raises, promotion, or social rewards. A low-power source, conversely, would control no rewards.
9. *Schedule of Feedback.* This dimension basically reflects the reinforcement schedule of the feedback. Examples of such schedules would include continuous (after every response), fixed interval (weekly, yearly), and variable interval (at different points around some average length of time).
10. *Group vs. Individual.* This dimension concerns whether the feedback presented deals with the individual alone or his entire work group. For example, information about the progress of a given group project may tell the individual very little about his own behavior.
11. *Comprehensiveness.* This dimension is defined as the percentage of the role covered by the feedback. If the feedback dealt with only one aspect of a complex job, it would be low in comprehensiveness.
12. *Formal – Informal.* Feedback along this dimension concerns whether or not the individual has an expectation of receiving feedback prior to the feedback encounter. An annual performance appraisal interview would be an example of formal feedback. Informal feedback is more random in nature and would not be expected prior to the encounter.
13. *Public – Private.* This dimension refers to whether feedback is given to the individual alone or in the presence of others, who would most generally be members of the individual's work group.
14. *Accuracy.* Accuracy refers to the validity of the information; that is, the extent to which the information given to the person validly reflects the true state or nature of his or her performance.

With this review of the pertinent literature and generation of the feedback taxonomy, the first step in the research was to select those types of feedback to be manipulated in the study. Based primarily on their feasibility of implementation in an operational setting, the following feedback types were experimentally manipulated.

1. Specificity: High vs. Low
2. Personal, Evaluative vs. Impersonal, Nonevaluative
3. Timing of Feedback: Delayed vs. Immediate
4. Group vs. Individual
5. Public vs. Private

Job Design

The second set of manipulated variables dealt with job design, which has attracted a great deal of attention in other studies. During most of this century, the focus has been on the principles of scientific-management, which entails simplifying jobs in the interest of cost-effectiveness and efficiency. More recently, the focus has turned to the limitations and problems brought about by specialization. Current approaches have emphasized job enlargement, or the re-integration of jobs, with maximum consideration being given to psychological variables hypothesized to provide jobs with intrinsically motivating characteristics. Our primary concern in this study is the aspect of job design which deals with the degree to which a worker does a complete unit of work. However, a review of the literature must also give some attention to other aspects of job design as well. Thus, we shall discuss job design in the broad context and attempt to focus in some detail on the complete unit issue.

Taylor's (1911) scientific-management approach to job design has certainly had a major impact on job design. His focus on efficiency and cost-effectiveness led to the breaking down of jobs into their component tasks and to the concept of specialization. By the 1950's, however, some people became aware of limitations of such an approach, or as Kilbridge (1960) stated, the law of diminishing returns overtook job specialization. Numerous studies appeared indicating worker discontent with the monotony and repetition inherent in over-specialized jobs. Walker (1950) reports that, for IBM machine operators, low morale and low quality resulted from too severe task specialization. Walker and Guest (1952) found that 90% of employees on an assembly line disliked their jobs, primarily because of "mass production characteristics," such as repetitiveness, lack of variety, monotony, and lack of control over their jobs. The workers' most consistent complaint concerned the constant pace of the assembly line. Similar attitudes were reported by van Beek (1964) from employees working on an electronic components assembly line in the Netherlands. Whyte (1955), in a study with glass industry workers, noted their distrust of the "time-study man" and the large amounts of time and energy spent devising ways to foil any such intrusion into their jobs.

The issue of simplifying jobs merely for the sake of simplification was directly addressed in a cost analysis study by Kilbridge (1960). He combined several sub-tasks for pump assemblers into one job so that one man became responsible for the assembly of a pump, rather than four to six men as was the case previously. Focusing solely on production cost analysis, Kilbridge demonstrated that, all costs considered, one man could assemble a pump for less expense than either four or six men, with the greatest savings being in time.

In questioning some of the practices and assumptions of Taylor's theory, researchers discovered limits to such an approach. A crucial aspect ignored by Taylor was the human, psychological costs that could result from total simplification of jobs. These costs have been manifested in the form of absenteeism, turnover, discontent, eventual inefficiency, and the like (Kilbridge, 1960, van Beek, 1964; Walker, 1950; Walker & Guest, 1952; Whyte, 1955). Out of this research grew an expanded conception of job design, considering a wide variety of variables for inducing more efficient production. A realization developed that human costs had to be included in production costs. In reaction to the long standing tradition of job simplification, most subsequent research has concentrated on job re-integration.

As the field of job design, or re-design, has grown, the terminology associated with this topic has also grown. Terms such as job simplification, job rotation, job change, job expansion, job enlargement, and job enrichment have proliferated. Briefly, job simplification has referred to the process of breaking jobs down into their component parts, essentially the scientific-management approach. The other descriptions are concerned with job re-integration, or the putting-back-together of jobs.

Job enlargement has been the most widely used and has the most varied meanings associated with it of all the terms in job redesign vocabulary, thus making it nearly impossible to clearly define. However, some generalizations have been made. Both Herzberg (1968) and Lawler (1969) have differentiated between vertical and horizontal enlargement. Horizontal enlargement has been described as dealing primarily with the number and variety of operations performed, whereas vertical enlargement has tended to be concerned with the degree to which a worker controls the planning and execution of the job and with the possible participation of the worker in setting organizational policies. The former is often characterized as job expansion, job combination, or job change. These latter descriptions exemplify the form of early "job enlargement" interventions. While Herzberg (1968) and Herzberg, Mausner, and Synderman (1959) have contended that these two dimensions are independent, most other theorists have concluded that the two at least overlap (Hinton, 1968; Katzell et al., 1975; Lawler, 1969; Watson & Zumbro, 1977).

Walker (1950) described a case of job enlargement in an IBM plant, where the tasks of machine setup, care of tools, and inspection of the finished product were combined into one job. The focus was on increasing interest, variety, and responsibility; while issues of intrinsic motivation and self-fulfillment, were not explicitly addressed. Findings showed that product quality increased, idle time decreased, and measures of interest and satisfaction rose. As a note of caution, Walker pointed out that the conditions were ideal for the program to succeed. Similar reasoning was put forth by Walker and Guest (1952) in their study of assembly line workers. These researchers proposed two suggestions designed to relieve the strain of working under the constant pace of the assembly line, namely, job rotation and job enlargement. First, rotating workers through different tasks should decrease monotony and give individuals an overall view of the assembly process so that they could see their impact on the finished product. In addition, a worker would become a skilled workman, adept at several tasks. Theoretically, job rotation would have resulted in increased quality, decreased turnover, but possibly some decrease in output. Job enlargement was aimed at recombining tasks in order to generate a feeling of wholeness of the job on the part of the worker. Walker and Guest believed that the subdivision of jobs had passed the point of diminishing returns and recombination was necessary. As evidence for this position, they reported that, up to a point, just increasing the sheer number of tasks helped raise employee satisfaction. During this time period, the motivational effects of wholeness of job and having an overview of the job process were at an intuitive level; no theoretical base existed proposing specific psychological processes linking these interventions with productivity or satisfaction. Theories would be developed later.

Herzberg (1968) formulated a theory of job enrichment, arguing that the way to increased satisfaction and productivity was through motivation, and that this could best be accomplished by creating enriched jobs, a process which he referred to as vertical loading (as opposed to horizontal loading).

One important aspect of this theory has been the function of work itself as a motivator. Herzberg et al. (1959) have argued that one's work can be a long-term satisfier because it is tied into long-term goals, whereas other motivators and "hygiene" factors often tend to be related to shorter-term goals. Consequently, those aspects of work that lead to satisfaction and motivation deserve greater attention. Furthermore, although the notion that "hygiene" and motivating factors are totally independent of each other has been extensively criticized (Hinton, 1968; Lawler, 1969; Watson & Zumbro, 1977), Herzberg's focus on motivators has spawned considerable research in the area that generally substantiates his list of factors most heavily influencing intrinsic motivation.

Davis and Werling (1960) performed a correlational field study concerning job enlargement. A component analysis of their questionnaire revealed eight pertinent factors related to enlarged jobs, including the perception of having a full work assignment, perception of the job as being important, and

control over the organization of work, rate and variety, and preparatory activities. Here, as in Herzberg's two-factor theory, work itself was found to play a prominent position in enlarged jobs. Finally, Davis and Werling reported that enlarged-job groups produced higher quality products at a higher rate than un-enlarged-job groups, and the former also exhibited better interpersonal relationships and more positive work attitudes.

Turner and Lawrence (1965) hypothesized six "requisite task attributes" (RTA), or required job characteristics, that they thought would be positively related to satisfaction and attendance: (a) variety, (b) autonomy, (c) required interaction, (d) optional interaction, (e) knowledge and skill required, and (f) responsibility. They also generated an "associated task attribute" (i.e., not required by the task itself), thought to correlate positively with satisfaction and attendance, namely task identity, which they define in terms of clarity of work cycle closure, visibility of transformation of work material, visibility in the finished product, and the magnitude (value added) of transformation. Since the individual RTAs were closely related to each other, the researchers constructed a summary RTA index through a linear combination of the individual attributes. This summary was used to determine relationships between the attributes and the dependent variables. This study represents one of the first to clearly define hypotheses and attempt to devise and operationalize adequate measures. For the population as a whole, results indicated that task identity was significantly correlated with attendance, although less strongly than the RTA index. Task identity was also related to reward, and task complexity was associated with time investment. Identity was not significantly related to job satisfaction.

More recently, Hackman and Lawler (1971) have presented a conceptualization of task design. They argue that four "core dimensions" exist that influence the motivational potential of a job: (a) variety, (b) task identity, (c) autonomy, and (d) feedback. Theoretically, these factors allow an individual to feel personally responsible for his work (autonomy), provide meaningful and worthwhile outcomes (variety and task identity), and knowledge about what has been accomplished (feedback). The authors hypothesize that these dimensions can enhance the intrinsic motivation of individuals who desire higher order need satisfactions. Performing well on jobs high in variety, task identity, autonomy, and feedback should lead to relatively high levels of satisfaction. In order to test their theory, Hackman and Lawler developed measures of the core dimensions, two additional interpersonal relations dimensions, and an index of desire for the satisfaction of higher order needs. Hypotheses were made, based on theoretical considerations, and tested. Data were collected on 13 different jobs in a telephone company, encompassing 208 employees.

The results generally showed positive relationships between all four core dimensions and the dependent variables of intrinsic motivation, satisfaction, performance, and attendance. One interesting finding suggested that the dimensions were associated with high quality work but not high quantities of work, reminiscent of Walker (1950) and Walker and Guest (1952). This finding was interpreted as indicating that quality was more important than quantity with respect to meaningfulness of work. However, alternate explanations of the quality/quantity issue should be explored, including (a) the nature of the tasks, (b) the emphasis of production (quality vs. quantity), and (c) an individual's personal inclinations. A second major point was that the core dimensions tended to be most strongly related to those specific satisfaction items concerned with personal satisfactions, accomplishments, and growth and less strongly associated with items extrinsic to the job itself such as pay, promotion, and respect from the boss. Hackman and Lawler concluded from these results that the core dimensions were strongly related to higher order needs (see Maslow, 1943).

Three other findings of some import were also discussed. First, a number of relationships, although not all, were moderated by need strength. In virtually all cases, the correlations between jobs rated high on the core dimensions and the dependent variables were greater for high need individuals than for low need individuals and in about one-third of the cases, the correlations were significantly greater. Second, evidence is presented that jobs should be high on all core dimensions in order for a profound effect on motivation to be noticed. However, none of the dimensions was studied independent of the others. Finally, in opposition to the Herzberg theory, these authors conclude that both horizontal and vertical dimensions influence intrinsic motivation, although the latter has relatively greater impact.

The most recent and probably most elaborate theory of task design has been offered by Hackman, and Oldham (1975, 1976) and their associates (Hackman, Oldham, Janson, & Purdy, 1975). They developed their theory in response to what they described as little existing knowledge on the effects of job change, inadequate theories, methodological difficulties, and poor measures (Hackman & Oldham, 1975). Consequently, the intermediate goals of constructing a measuring device and specifying methodological problems were incorporated into the ultimate objective of deriving an adequate theory. As will become evident, this theory has relied heavily on the previous works of Hackman and Lawler (1971) and Turner and Lawrence (1965).

Hackman et al. (1975) have proposed that five core dimensions lead to critical psychological states that influence personal and work outcomes. Furthermore, the relationships between outcomes and job dimensions have been hypothesized to be moderated by growth need strength. Based on these conceptualizations, a formula for calculating a motivating potential score (MPS) for jobs was derived. In order to test this theory, Hackman et al. developed the Job Diagnostic Survey (JDS), which measures the objective job dimensions, individual psychological states, affective responses of workers to the job and work setting, and individual growth need strength. With the use of this instrument, results have been obtained supporting the theory (Hackman & Oldham, 1975, 1976; Hackman et al., 1975). However, these supporting studies have considered the job dimensions as a group rather than investigating the effects of individual dimensions. Consequently, the role of each has not been well understood. In addition, the research has not provided overwhelming support as correlations tended to be low, although statistically significant, and not all of the expected relationships were found.

In a test of this model, Lawler, Hackman, and Kaufman (1973) redesigned the jobs of directory assistance telephone operators. For these operators, the perceived variety and autonomy increased significantly; task identity and feedback increased only slightly. Whole-job satisfaction declined significantly, while motivation dropped somewhat. The supervisors' scores declined on all satisfaction measures. In this study, an attempt at providing detailed measures and experimental controls (i.e., another group of operators) garnered mediocre results. An important issue was raised, however: the reactions of related groups (supervisors) to enlargement not specifically directed at them and how they might affect the outcome of an enlargement intervention.

Numerous other investigations have looked at job enlargement, but they have approached the subject with a holistic viewpoint, conjecturing post hoc on which factors were responsible for observed changes. Furthermore, the results have been inconsistent, so no definitive conclusions are available. The major cause for equivocal findings has been the lack of systematic investigation. Most organizations that have implemented enlargement programs have done so without experimental controls and in the presence of contaminating variables. In order to illustrate problems that arise, some of the more influential studies in this area are discussed in the following paragraphs. These studies should be considered in the context of previously cited investigations, which have been generally supportive of the concept of job enrichment.

Ford (1969) put Herzberg's theory into practice at AT&T on several different jobs. He reported that enrichment interventions, including task identity, providing challenging work, and increasing responsibility, resulted in greater job satisfaction, better relations, and higher production. His design was geared toward creating intrinsically motivating jobs. Unfortunately, several factors were introduced simultaneously and measures were either minimal or non-existent, thus making it difficult to draw precise conclusions. Hackman and Lawler (1971) also noted that replications based on Ford's work have been non-supportive. Herzberg (1968), on the other hand, presents support for investigations based on his theory.

Davis and Valfer (1965) conducted a longitudinal study in which, beginning with their current job, the roles of supervisors were sequentially increased to include responsibility for (a) product completion and (b) quality control. In essence, the original job of floor supervision was modified into a complete task unit with supervisors having authority over the entire production cycle. The findings showed that quality improved and costs associated with quality decreased, but productivity remained approximately the same. Supervisors felt increased satisfaction and autonomy and were better liked by their subordinates. Again, however, several changes were made during the course of the investigation, and there were no adequate control groups.

Kilbridge (1960), as discussed previously, provided an example of how integrating several sub-tasks into a complete job (assembling pumps) led to diminished costs, especially with respect to time. No effort was made to measure either satisfaction or quality.

Lawler (1969), in a symposium on task design, presented 11 studies in which jobs were enlarged both horizontally and vertically; 10 of these reported increases in quality, and three found increases in productivity. It should be noted that increases in quality did not necessarily indicate a drop in productivity; rather, productivity generally remained unaffected.

Adverse effects can also result from job enlargement interventions, as already shown by Lawler et al. (1973). Whyte (1969) has also discussed potential negative consequences. Alderfer (1969) found that the most significant results of an enlargement program in a manufacturing plant were severely strained relations between supervisors and subordinates. Unfortunately, this and other findings related to satisfaction and job enlargement were contaminated by the fact that the participants in the program were pre-selected, and job enlargement was accompanied by the introduction of new machinery and a special training course for participants.

Bishop and Hill (1971) investigated the effects of job enlargement, job change, and status on product quality and quantity, worker satisfaction, and tension in an experimental setting. Workers were divided into three groups: enlarged, changed, and control. At the end of 5 days, quality had decreased for both manipulated groups, with the enlarged-job group showing the greatest decline. Job change showed an increase in satisfaction while job enlargement resulted in a decrease in satisfaction. Finally, the control group showed the greatest increase in anxiety and also a drop in status as perceived by the other groups. These results were difficult to interpret because the setting was a sheltered workshop and generalizability may be limited. Nevertheless, this study suggests that job enlargement may not always work, horizontal enlargement may be more effective, or less detrimental (see Walker & Guest, 1952), peripheral groups may be affected (see Alderfer, 1969; Lawler et al., 1973; Whyte, 1969), and quality may be the most sensitive production dimension (see Hackman & Lawler, 1971; Lawler, 1969; Walker & Guest, 1952).

The most striking aspect of the field of job design is the lack of conclusive findings. One is left with the impression that the "art" of job redesign, especially job enlargement, is not well understood. There appears to be consensus in the belief that job design is multidimensional in nature (Pierce & Dunham, 1976), and at least some agreement exists as to what a few of those dimensions are (Hackman & Lawler, 1971; Hackman & Oldham, 1975, 1976; Turner & Lawrence, 1965). In addition, it seems clear that individual differences play a significant role in the outcomes of working on an enlarged job (Hackman & Lawler, 1971; Hackman & Oldham, 1975, 1976; Lawler et al., 1973; Turner & Lawrence, 1965).

Pierce and Dunham (1976) arrived at similar interpretations, concluding that enlarged tasks were more frequently associated with positive affective, motivational, and behavioral responses than were narrowly defined tasks. Satisfaction showed the greatest association, while behavior evidenced the lowest association. All but one study reviewed showed improved work-related behavior associated with task design. Among their criticisms of research in the field, Pierce and Dunham listed a reliance on self-report, little distinction between perceived vs. objective design characteristics, and too many dimensions explored simultaneously. Both Katzell et al. (1975) and Watson and Zumbro (1977) voiced essentially identical conclusions. Watson and Zumbro stressed that, as a potentially useful redesign tool, job enrichment should be further investigated to afford increased understanding so that it may be used effectively rather than haphazardly. Katzell et al. also observed the potential of job design in motivating through aspects of job content. In order to better understand the processes involved, they have suggested focusing on the dimensions of diversity, difficulty, identity, feedback, interaction, cycle-time, and control.

This present study has attempted to address some of the problems prevalent in the literature. An experimental setting was chosen, and the independent variables were chosen for indepth study. The degree to which a person does a complete unit of the task was the variable selected, because of its relative ease of operationalization and its previous lack of emphasis despite several references to its importance. In addition, the majority of studies investigating enlargement programs have actually created a whole job as

part of their manipulation but have never examined this issue directly (see Bishop & Hill, 1971; Davis & Valfer, 1965; Lawler et al., 1973; Walker, 1950).

II. METHOD

Overview

The method used in the study was a work simulation. Subjects were hired for what they believed to be a real job of 3 weeks duration. They were recruited from the Lafayette-West Lafayette (Indiana) area using advertisements in the local newspaper. It was felt that a population of this type would be more comparable to an Air Force population than the exclusive use of college students. The task selected was considered to be analagous to tasks actually done in some Air Force job specialties. Specifically, it was an inventory control task wherein subjects processed purchase requisitions. It was designed to be highly realistic and representative of the way a job of this type would actually be performed.

Subjects in this study consisted of five experimental groups, each of which went through a series of different conditions. All of the five independent groups started with a day of training on the task and a second day devoted to practice. They then went through a series of experimental conditions which utilized different types of feedback and/or different degrees of completeness of the task. The primary dependent variables were quantity of performance, error rate, and job satisfaction.

Subjects

After the subjects used in this project were recruited (using a job advertisement in a local newspaper), the only information they were given prior to reporting for work was that this was a short-term clerical job with Purdue University and that no special skills were required. Subjects were paid \$2.40 per hour. The sample had 28 men and 69 women, and their ages ranged from 16 to 52, with a mean age of 22, and a standard deviation of 6.5.

Experimental Task

The task was designed to resemble a real inventory control job. Subjects were given a quantity of purchase requisitions to process. The essential portion of the requisition forms indicated the requestor's user code and the items being requested. Each item was entered with its identification number, its name, and the number of units ordered. (See Appendix A for a sample purchase requisition.) The number of items on a purchase requisition varied from four to six and averaged five. In order to equate difficulty, the orders were arranged so that, within each set of six purchase requisitions, the mean number of items per requisition was exactly five.

Subjects were also given a computer printout of the approximately 2000 items contained in the Purdue General Stores. The printout contained a variety of pieces of information, including the item identification number, item name, number of units of that item currently in stock, minimum reorder point, and reorder quantity. The minimum reorder point referred to the number of units in stock below which an order for more units would be made by Purdue General Stores to their supplier. In other words, when the inventory in stock fell below that point, the item should be ordered to replenish the depleted stock. The reorder quantity referred to the number of units Purdue General Stores would order from their suppliers when an order was made. (A sample of this computer output is presented in Appendix B.)

In performing the task, the subject first examined the "user code" which appeared on a purchase requisition and then consulted a list of "authorized user codes." The subject had to ascertain whether this user (i.e., user number) was authorized to order from the General Stores. If the user code number was not on the "approved" list, the subject so indicated, but completed the requisition. Subjects were told that an accounting adjustment had to be made for these accounts and that was the reason for checking the number. An unauthorized account number appeared relatively infrequently, averaging once in every set of 10 purchase requisitions.

The subject then went to the items ordered on the purchase requisition, and, after first finding the ordered item in the printout, determined whether there were enough units in stock to fill the order. If there were enough in stock, a check mark by that item on the purchase requisition was placed and the amount ordered was deducted from the number of units in stock. After this new balance was written on the purchase requisition, the subject then checked to see whether this new amount in stock fell below the minimum reorder point, shown on the printout. If it did not, the subject went on to the next item. If the new balance fell below the minimum re-order point, the subject filled out a "reorder form" (See Appendix C for a copy of this form) and ordered the quantity labeled "reorder quantity" in the printout. If the new balance actually fell below zero, the subject completed an "out of stock form" (See Appendix D for a copy of this form.), as well as a reorder form. On the out of stock form, the subject indicated the amount ordered, the amount shipped, and the amount backordered.

The design of this task allowed for distinct quantity and quality measures to be made. Quantity was defined as the number of purchase requisitions completed in an hour, and quality was defined as the number of errors made per hour. In addition to an overall error rate, specific errors were also identifiable. There were eight types of errors possible: (a) incorrect determination of authorized user number, (b) incorrect location of an item in stock, (c) incorrect deduction from stock, (d) failure to indicate on purchase requisition that a backorder should be made, (e) failure to place a re-order when the stock level for an item fell below the reorder point, (f) an error in completing the reorder form, (g) failure to send an out of stock form and (h) an error in completing the out of stock form. In those cases where errors were dependent on each other, the subject was assessed only one error. For example, if the subject made an incorrect deduction from stock and, as a result, the new balance did not fall below the reorder point as it should have, no "reorder done" error was assessed.

In order to equate task difficulty, there was a specific number of each of the contingencies in each set of 30 items (i.e., six purchase requisitions). Specifically, out of every 30 items, eight required that a reorder form be completed, and for four of these eight, the subject would have to complete an out of stock form. Although the forms and procedures were designed or selected specifically for this research, and the materials were selected to have maximum realism and face validity, the orders themselves were not actual.

Procedures

Subjects reported to an on-campus work site, where they were met by three experimenters. They were told that the experimenters were working in conjunction with the purchasing department at the University on an investigation of new methods of inventory control for the Purdue General Stores function. They were then told that the job would last for 3 weeks and that they would work 3 hours per evening, Monday through Thursday of each week. Each subject was then given a battery of tests ostensibly to determine if he or she was qualified for the job. The battery used was the Short Employment Tests (Bennet & Gelink, 1951), consisting of tests of clerical aptitude, numerical ability, and verbal ability. The experimenters then glanced over these tests and indicated that there appeared to be no problems with anyone's test performance. They implied that the tests were basically a formality and that no one should be concerned with the score. Following the introduction and testing, training on the task was begun. The remaining portion of the first day was used for training in order to insure that all subjects completely understood the task. In addition, at the beginning of the second day, a complete review was given. As mentioned previously, the remainder of the second day was used to establish a baseline for performance.

In order to use this practice day as a baseline, it was important that the subjects were not still learning the task. If they were, that is if they were improving their performance due to experience in working on the task, the baseline performance data would be an underestimate of performance. Data are available on this issue from previous research using this task (Pritchard & Montagno, 1978). This previous study used the same task and the same training day-practice day format. The results of both the pilot testing and the actual study demonstrated conclusively that the subjects were not improving their performance during the practice day, thus clearly suggesting that no further learning was taking place. (See Pritchard and Montagno, 1978, for a complete presentation of these data.)

Five feedback dimensions were experimentally manipulated. The first was actually a combination of two dimensions. It consisted of giving Personal-Evaluative feedback or giving Impersonal-Nonevaluative feedback. In the Personal-Evaluative conditions, a subject met each working day with the supervisor in a small room near the main work room. In these one-on-one sessions, the supervisor gave the subject feedback on his or her performance for the previous work day. While the feedback was given in written form (See Appendix E for a copy of the written feedback sheet), the major feature of the Personal-Evaluative manipulation was oral. The supervisor verbally went through the feedback and indicated whether that level of performance was Excellent, Above Average, Average, Below Average, or Poor. This designation of performance was based on actual distribution of performance on the task from the Pritchard and Montagno, 1978 study. In addition, the supervisor made a series of verbal statements that indicated personal satisfaction with that level of performance. For example, for Excellent performance, the supervisor said "This is really excellent. I could not be more pleased with your work. I am really delighted with this." Thus, in the Personal-Evaluative format, the feedback was given in a face-to-face manner by the supervisor, and there was a strong evaluative component to the feedback.

The Impersonal-Nonevaluative feedback was done much differently. The feedback given to subjects in this condition was given only in written form (see Appendix F). It was passed out to each subject by a person who was not the supervisor, and who was recognized by the subjects as not having any authority over the group of any kind. The only time the subjects saw this person during the treatments was during delivery of the feedback sheets at the beginning of each workday. The supervisor was not present in the room when the feedback sheets were distributed, and it was made clear to the subjects that the feedback was not seen by the supervisor. Finally, the feedback included only a description of their performance in terms of quantity of requisitions finished and number of errors. No evaluation of any kind was made as to whether this level of performance was good or bad. Thus, in the Impersonal-Nonevaluative format, the feedback was merely delivered, the "source" was a low-power Other, and there was no formal evaluative component to the feedback.

The second feedback dimension manipulated was degree of feedback specificity. In the Low Specificity feedback format, subjects received information on the number of requisitions they had completed, and the number of requisitions containing one or more errors. In the High Specificity conditions, subjects were given the preceding information, but were also given a breakdown by type of error. That is, the eight possible errors were listed on the feedback sheet, and the frequency of each type of error was listed (see Appendix G for a copy of this form).

The third manipulated feedback dimension was immediacy of feedback. In the Immediate conditions, feedback was given on the day immediately following the performance. In the Delayed conditions, the feedback given was for work done several days before. Two levels of Delayed feedback were used. In one condition the delay was 3 workdays after the actual work. For example, on a Thursday, the subject received feedback about the work done on Monday. On the next workday, the subject would receive feedback on work done Tuesday, etc. In the other Delayed feedback condition, the time delay was longer. Specifically, in this condition feedback was given for work done 5 workdays previously. Since subjects worked Monday through Thursday, this meant that in all cases 8 actual days separated the performance from the feedback about that performance.

The fourth manipulated feedback dimension was Group vs. Individual feedback. In the Individual feedback conditions, the feedback was based on the individual's own performance; that is, each person received quantity and error data on his or her own performance. In the Group feedback condition, subjects received feedback about the group's performance as a whole. They were given quantity and error data averaged across the whole group. They were not given their own individual data.

The fifth manipulated feedback dimension was Public vs. Private feedback. In the Private conditions, each subject was given feedback only about his or her own performance. In the Public conditions, each subject received a sheet containing the names and feedback for each person in the group. Thus, everyone in the group knew exactly how all others in the group were performing.

The final manipulated variable in the study was Complete vs. Incomplete Unit of the task. The idea here was to have one format where each subject performed the whole task and another format where each subject performed only a fraction of the task. In the Complete Unit version of the task, each subject went through the entire set of operations to process a requisition. In the Incomplete version, each step was broken down, and a given subject worked only on one step. Specifically, the task was broken down into four separate and independent operations. These were (a) checking for authorized user codes, (b) looking up items on the printout, making deductions, and indicating whether reorder and out of stock forms were necessary, (c) filling out reorder forms, and (d) completing out of stock forms. Thus, each subject worked on one and only one of the four steps when under the Incomplete Unit format.

Several features should be noted about the Incomplete Unit format. First, the four operations were selected so as to preclude any duplication of effort; that is, the same steps were done in the Incomplete Unit as in the Complete Unit, and in no case was a given step done twice. This is important for being able to compare performance under the Complete and Incomplete versions of the task, but this will be discussed more fully later. Second, each subject had his or her own supply of work which was replenished as needed; that is, the work was arranged so that one subject was not dependent on another subject for a supply of work.

Design

The actual experimental design is presented in Table 1. There were five independent groups, labeled 1 through 5 in the rows of the table. Each of the five groups went through a variety of treatments, labeled A through E in the columns of the table, in a repeated measures format. For example, Group 1 started with a training day and a practice, or performance baseline day. They then went to Personal-Evaluative feedback (abbreviated "Personal"), which was of Low Specificity. As the footnote in the table indicates, it was also Private, Individual, and Immediate feedback, and the subjects worked on the Complete Unit version of the task. They then went to Personal, *High Specificity* feedback (cell 1C), and finally to Personal, High Specificity, *Public* feedback (cell 1D).

The remainder of the design is self-explanatory from inspection of the tables. The only exception is the Complete-Incomplete Unit conditions. These are found in cells 3A-C, 4A-C, and 5A-C. It was felt worthwhile to look at order effects in the manipulation of the Complete-Incomplete Unit. Consequently, in cell 3B, subjects worked on the Incomplete version and were then switched to Complete (3C). In cell 4B, subjects worked on Complete and then were switched to Incomplete (4C). Group 5 represents a replication of group 3 in that they went from Incomplete (5B) to Complete (5C), but for this group, performance feedback was also given.

There were some differences in the practice, or baseline, day for these groups. Group 4 operated as described previously, but Groups 3 and 5 were treated differently. Since after practice, these groups were to start on the Incomplete version of the task, their practice day was spent working on the Incomplete version. However, it was felt necessary for these groups to clearly perceive that the task they were working on was, in fact, a decomposed version of the total task. Thus, these two groups were trained the first day to do the Complete task, but on the practice day, they were told that each would be working on a sub-part of the total task. They then proceeded to work on the Incomplete version.

Several more general points should also be noted about the design. First, all feedback given was factual; that is, the work was actually counted and scored for errors, forming the basis of the information fed back to the subjects. Second, the actual scored output that the feedback was based on was available in the room for the subject's inspection. Thus, realism was added to the feedback by having the actual work present for inspection. As had been anticipated, few subjects actually looked through their previous work, and those few who did typically did so only once.

Finally, the transitions from one condition to another for a given group were designed to be "logical." That is, attempts were made in the design and instructions to make the change from one condition to another appear reasonable. For example, when feedback was introduced for Group 1 (cell 1B),

Table 1. Experimental Design^a

Group	Condition A	Condition B	Condition C	Condition D	Condition E
1	Day 1 - Training	Personal	Personal	Personal	None
	Day 2 - Practice	Low Specificity Days Worked = 3	High Specificity Days Worked = 3	High Specificity Public Days Worked = 4	
2	Day 1 - Training	Impersonal	Impersonal	Impersonal	Complete Unit Immediate Low Specificity Days Worked = 1
	Day 2 - Practice	Low Specificity Days Worked = 3	High Specificity Days Worked = 3	High Specificity Public Days Worked = 4	
3	Day 1 - Training	Incomplete Unit	Complete Unit	Complete Unit	Complete Unit Immediate Low Specificity Days Worked = 1
	Day 2 - Practice	No Feedback Days Worked = 2	No Feedback Days Worked = 3	Delayed (Short) Low Specificity Days Worked = 2	
4	Day 1 - Training	Complete Unit	Incomplete Unit	Complete Unit	Complete Unit Immediate Low Specificity Days Worked = 1
	Day 2 - Practice	No Feedback Days Worked = 2	No Feedback Days Worked = 3	Delayed (Long) Low Specificity Days Worked = 2	
5	Day 1 - Training	Incomplete Unit	Complete Unit	Complete Unit	Complete Unit Group High Specificity Days Worked = 3
	Day 2 - Practice	Immediate Low Specificity Days Worked = 2	Immediate Low Specificity Days Worked = 3	Group Low Specificity Days Worked = 2	

^aUnless otherwise indicated, all conditions used Private, Individual, Impersonal, Immediate feedback and worked on the Complete Unit version of the task.

they were simply told that "We have processed your work from yesterday (the practice day) and have that information for you." When the group was changed to High Specificity (cell 1C) they were told "We have been able to refine the procedures of processing the requisitions so that we are able to give you more information than we could before." When the group went to Public feedback (cell 1D), they were told "We thought you might be interested in how the other people are doing, so we have included that information on your sheets." As another example, Group 4 started out on the Complete Unit (cells 4A and 4B), and when switched to Incomplete Unit (cell 4C), they were told that "We think it will be better to [redacted] the operation more, so we have decided to have each person work on only one phase of the task. [redacted] they were switched back to Complete Unit (4D), they were told "This procedure of specializing is proving too complicated for the processing we have to do after you work on the requisitions, so we have decided to go back to the way we did it before."

III. RESULTS

With the methods and procedures of the study in mind, we now turn to the results, which are presented in two major sections. The first section presents the main effects analyses comparing each manipulated variable. The second section presents those sections of the design where interaction between the manipulated variables can be assessed. From a technical point of view, it is inappropriate to consider main effects without simultaneously considering interactions. However, the complexity of the results is such that consideration of the main effects first will allow an overall picture of the findings. The results of the interactions will, of course, be considered in making later interpretations of the results.

Personal-Impersonal Feedback

The comparison of Personal with Impersonal feedback in regard to performance was done with a 2 x 2 design. Cells 1B, 1C, and 1D all used Personal, Evaluative feedback. Cells 2B, 2C, and 2D were parallel cells except that they used Impersonal, Nonevaluative feedback. Thus, the mean of the three Personal cells (1B + 1C + 1D) and the mean of the Impersonal cells (2B + 2C + 2D) was used in these analyses. The other two cells were the respective practice, or baseline, conditions (1A for Personal, 2A for Impersonal) where no feedback was given.

Means and standard deviations of the major variables for the complete design are presented in Table 2. Means for quantity and quality of performance for the Personal-Impersonal analyses are presented in Figure 1. The 2 x 2 analysis of variance (ANOVA) for quantity of performance indicated only one significant effect: performance was higher with feedback than with no feedback ($p < .00001$); thus, feedback had a strong positive effect, with quantity being 23% higher with feedback than without feedback. However, Personal and Impersonal were not significantly different ($p < .67$); thus, while both Personal and Impersonal feedback had a positive effect on quantity, neither was superior to the other.

The second graph in Figure 1 presents the mean errors by condition. The means indicate that the group with Impersonal feedback decreased their frequency of errors, while the Personal feedback group increased their errors. The overall test of these differences, i.e. the interaction, was marginally significant ($p < .07$). The means also indicate that the Impersonal group had more errors than did the Personal group ($p < .006$), but this effect is not interpretable as such; that is, this difference is caused by the fact that under conditions of no feedback, one group had higher errors than the other. The critical point is that the two groups were treated identically during this condition and any differences here were simply due to chance differences between the two groups, not to any differential feedback treatment.

The final analysis compared overall job satisfaction under Personal and Impersonal feedback conditions. Since the satisfaction measure was not given for the practice day, this comparison simply involves testing the mean satisfaction for the three Personal cells with the mean for the analogous three Impersonal cells. While the mean satisfaction for the Personal conditions ($X = 184.8$) was greater than that for the Impersonal ($X = 151.4$), this difference was not significant ($p < .09$).

Table 2. Means, Standard Deviations and Sample Sizes, By Condition

	Condition A			Condition B			Condition C			Condition D			Condition E		
	X	SD	N	X	SD	N	X	SD	N	X	SD	N	X	SD	N
Group 1															
Quantity	10.67	2.83	17	12.30	2.37	17	13.43	2.56	17	13.47	3.61	17			
Errors	2.20	1.45	17	3.13	1.47	17	2.94	1.54	17	2.33	1.87	17			
Satisfaction				181.78	28.85	18	183.55	32.67	18	189.11	33.29	18			
Group 2															
Quantity	10.06	3.39	16	12.71	4.26	16	12.71	4.24	16	12.74	5.12	16			
Errors	4.47	2.43	16	4.56	2.18	16	3.37	1.84	16	3.22	1.70	16			
Satisfaction				163.94	37.28	18	161.00	26.02	13	159.18	33.75	17			
Group 3															
Quantity	11.76	2.98	16	11.71	4.10	16	14.24	3.57	16	11.45	3.68	16	10.25	3.71	16
Errors	2.16	2.25	16	1.56	1.49	16	4.45	3.76	16	2.77	2.19	16	2.23	1.58	16
Satisfaction				158.61	42.19	18	151.50	36.13	18	154.50	28.65	18	152.15	38.07	13
Group 4															
Quantity	13.40	2.71	12	15.31	3.16	12	15.10	2.59	12	16.62	3.00	12	14.84	3.44	12
Errors	2.13	1.76	12	4.26	1.93	12	2.64	1.87	12	2.40	.96	12	4.09	2.24	12
Satisfaction				178.94	33.35	16	172.75	34.13	16	177.43	36.96	14	174.28	37.16	14
Group 5															
Quantity	10.40	3.72	18	11.49	3.26	18	10.25	2.97	18	10.81	3.36	18	11.15	2.98	18
Errors	2.19	2.13	18	1.78	2.38	18	2.32	.84	18	2.24	1.25	18	1.92	1.20	18
Satisfaction				181.79	38.58	19	179.78	29.74	19	171.68	31.66	19	177.22	35.43	18

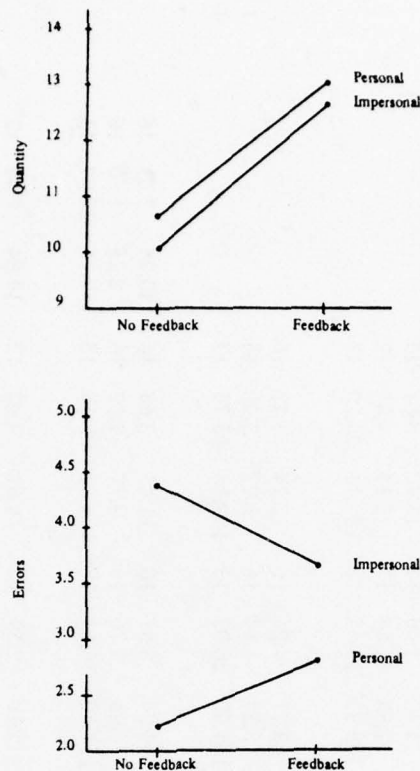


Figure 1. Personal-Impersonal feedback: Performance.

High-Low Specificity of Feedback

The primary performance analyses for the Specificity variable are in the form of a 1 x 3 ANOVA. The Low Specificity mean is formed by the average of cells 1B and 2B; the High Specificity mean is composed of the mean of cells 1C, 1D, 2C and 2D; and the baseline, no feedback, condition is formed by the mean of cells 1A and 2A. These means are presented in Figure 2. The 1 x 3 ANOVA on quantity resulted in a significant main effect ($p < .00002$). The no feedback condition resulted in significantly lower quantity ($p < .0001$) than did either feedback condition. High Specificity feedback was marginally significantly better ($p < .058$) than Low Specificity feedback. The analogous analysis in the error data showed a significant ($p < .0003$) main effect, with High Specificity displaying significantly fewer errors ($p < .00004$) than did Low Specificity.

In the above analyses the High and Low Specificity feedbacks were given in the individual format. Performance effects for High and Low Specificity can also be examined by looking at these conditions where feedback was administered on a group basis (cells 5D and 5E). Although there is no analogous No Feedback baseline for these cells since their practice day was under the incomplete unit condition, the High vs. Low Specificity comparison can be made. The results of these analyses showed that while the High Specificity group showed higher quantity and fewer errors, these differences were not significant ($p < .40$, $p < .39$, respectively).

Job satisfaction analyses were done for the High vs. Low Specificity for Individual feedback (cells (1B + 2B)/2 vs. (1C + 1D + 2C + 2D)/4) and for Group feedback (cells 5D vs. 5E). In both cases, overall satisfaction did not differ as a function of level of specificity of feedback, that is, respective p-values were $p < .69$ and $p < .21$.

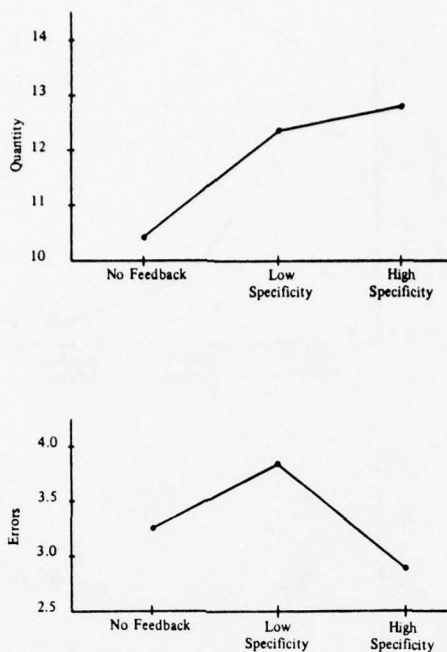


Figure 2. High-Low Specificity feedback: Performance.

Delayed-Immediate Feedback

Delayed feedback was compared with Immediate feedback in two ways. The first was to compare cells 3C, 3D, and 3E. In 3C, subjects worked on the complete unit with no feedback, and this cell thus serves as the baseline. In 3D, the subjects received delayed feedback; that is, feedback from their performance while working under cell 3C. This resulted in a time interval of 3 workdays between performance and feedback concerning the performance. In cell 3E, the feedback was immediate; that is, subjects received feedback about their previous day's work. The second way the Delayed-Immediate comparison was made used a longer delay interval; specifically, cells 4B, 4D, and 4E were compared. Cells 4B and 4E were baseline and Immediate feedback, respectively. In 4D, the Delayed feedback cell, the time between performance and feedback about that performance was 5 workdays, i.e., 8 actual days because a weekend and a Friday were included in every instance.

Thus, in the first set of cells, the delay of feedback was shorter than in the second set. Means and standard deviations for these cells are presented in Table 2 and Figure 3. Due to the fact that the Delayed feedback was not identical in the two sets of cells, a separate 1×3 ANOVA was done on each set. However, for ease of interpretation, means for both the Short and Long Delay comparisons are presented in Figure 3. Looking first at quantity, the figure indicates that the Long Delay resulted in higher performance than either no feedback or Immediate feedback, with the overall F being highly significant ($p < .007$). For the Short Delay, the overall F is also highly significant ($p < .0002$), with both Delayed and Immediate feedback finishing less work than did no feedback. Finally, a t-test indicates that quantity under the Long Delay was significantly higher ($p < .001$) than quantity under the Short Delay.

The error data are also presented in Figure 3. For the longer delay, the overall F is marginally significant ($p < .06$). The means indicate a tendency for fewer errors to be made under Delayed feedback than under either the no feedback or immediate feedback conditions. For the shorter delay, the overall F is

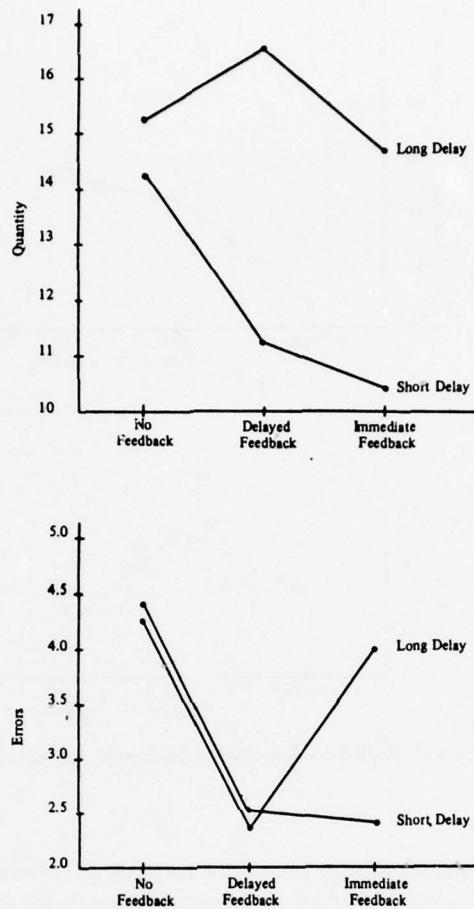


Figure 3. Delayed-Immediate feedback: Performance.

highly significant ($p < .003$), and the means indicate fewer errors under Delayed and Immediate feedback than under no feedback. Finally, comparisons of overall job satisfaction showed no difference for the three Long Delay cells ($p < .44$) nor for the three Short Delay cells ($p < .50$).

Group-Individual Feedback

The best test of Group vs. Individual feedback is the comparison of cells 5C and 5D; this is the same group under Low Specificity feedback in the Individual mode (5C) and the Group mode (5D). A second test can also be made, however; this is the comparison of cells 2C and 5E. Here, two independent groups are involved, both with High Specificity feedback; in 2C, Individual feedback was used, and in 5E, Group feedback was used.

Means and standard deviations for these cells are found in Table 2 and Figure 4. Due to the fact that the cells under High Specificity feedback (2C, 5E) were independent groups, and those under Low Specificity (5C, 5D) were the same subjects. Separate analyses were run on the two pairs of groups; however, for ease of presentation both sets are displayed in Figure 4.

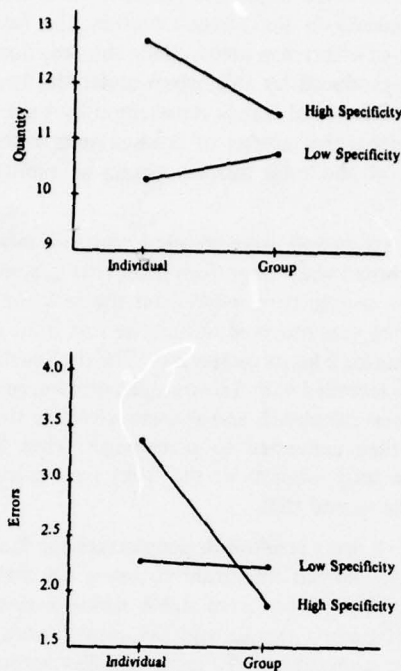


Figure 4. Individual-Group feedback.

In terms of quantity of performance, the analyses indicated that for the High Specificity groups, quantity was not significantly different under Group and Individual feedback ($p < .61$). For Low Specificity, Group feedback was slightly superior to Individual feedback, but the difference was only marginally significant ($p < .06$). The error data indicated that there was no difference in errors for the Low Specificity Individual vs. Group comparison ($p < .66$). For High Specificity, the Group feedback had significantly ($p < .004$) fewer errors than did the Individual feedback. Finally, there were no differences in overall job satisfaction between Group and Individual feedback in the Low Specificity conditions ($p < .18$). However, in the High Specificity conditions, subjects under Individual feedback displayed significantly higher ($p < .05$) job satisfaction than when under Group feedback.

Public-Private Feedback

The Public vs. Private feedback comparison was made by comparing the average of cells 1C and 2C, which were under Private feedback, with the analogous two cells, 1D and 2D, which were under Public feedback. The means and standard deviations are presented in Table 2. Analyses of these data indicated no significant differences in quantity ($p < .45$), errors ($p < .09$), or overall job satisfaction ($p < .17$).

Complete-Incomplete Unit

In the analysis of Complete vs. Incomplete Unit effects, six cells are involved in a 3×2 format. The first set of three cells consists of practice on the incomplete version of the task (3A), work under the incomplete version (3B), and work under the complete version (3C). The second set of three used the reverse order. Practice was under the complete version (4A), then subjects worked under the complete version (4B), and then were switched to the incomplete version (4C).

Before presenting the results of the Complete-Incomplete comparisons, another issue must be discussed. Specifically, any comparison of different forms of a task is difficult since subjects in the different

conditions are, in fact, working on different tasks. The design of the two conditions was constructed to deal with this problem. First, as discussed in the Method section, the Incomplete version of the task was structured so that no duplication of effort was made. Since this was done, it was possible to estimate the total number of Complete units produced by this group under the Incomplete version. To do this, one needs to know what percentage of the total task is represented by each of the four composite steps. With these percentages, one merely weights the number of finished units of the four subtasks by the proportion of time that subtask represents of the total task to obtain an estimate of total number of complete requisitions processed.

To obtain these estimates, six people were selected who had served as subjects in the study itself. They were chosen to represent a broad range of performance; that is, some had been high performers, some average, and some low. These six people then worked on the task for 3 hours, and were videotaped. A 30-minute segment of performance was observed during the first hour of work on the task, and another 30-minute segment was observed after 2 hours on the task. The time each subject took to complete each of the four subparts of the task was recorded with a stopwatch. An average time for each of the four subparts over the first 30-minute segment was calculated, and analogous average times were calculated for the second 30-minute session. These were then converted to percentages. Thus for each of the six subjects, four percentages (one for each of the four subparts of the task) were calculated for the first trial, and four percentages were calculated for the second trial.

Averaging across trials and subjects resulted in percentages for the four subtasks of 4.60%, 66.96%, 17.87%, and 10.79%. However, it was felt important to assess the stability of these estimates. The first comparison was to see whether these values were stable within a given subject over time. To do this, correlations between the first 30-minute sample and the second were calculated for each subject. The resulting correlations were .55 for each subject. To assess stability across subjects, the standard deviations of the six subjects' percentages on each of the four subtasks were calculated; these values were .83, 1.11, 1.66, and .83, respectively. Thus, these estimates are highly stable within and across subjects.

Cell means and standard deviations for the conditions are presented in Table 2 and Figure 5. Note that in the figure the abscissa is labeled "Practice, Incomplete Unit, Complete Unit." This is not the temporal order of the treatments for the Complete to Incomplete cells (4A, 4B, and 4C), but the temporal order of these means are rearranged for purposes of clarity on the figure.

The 3 x 2 ANOVA showed that the treatment effect was significant ($p < .0008$) indicating that quantity of performance was higher under the Complete Unit than under the Incomplete. However, inspection of the means indicates that this difference is accounted for primarily by the two groups which started on the Incomplete version of the task and then went to the Complete version. This notion is supported by the significant ($p < .04$) interaction and by the fact that the superiority of Complete over Incomplete was significant ($p < .05$) only for the group that went from Incomplete to Complete. A much different picture emerges when the error data are considered. The analysis shows a significant interaction ($p < .0001$) and a significant treatment effect. As the means are plotted in Figure 5, it is clear that the Complete Unit conditions displayed a substantially greater number of errors than did the Incomplete Unit conditions.

Means for overall satisfaction are presented in Figure 6. The analysis indicated no significant ($p < .10$) difference between the groups and a significant effect due to conditions ($p < .03$). However, this effect is in essence a comparison of the first time period (cells 3B and 4B) with the second (cells 3C and 4C). The means indicate that there was an overall decrease in satisfaction from the first condition to the second, and in view of the non-significant interaction, this decrease was equal for both of the groups. (Recall that the means as presented in Figure 6 are arranged in terms of Complete and Incomplete on the abscissa and not in terms of actual order of treatment.) To make any real interpretation of these data required an examination of the simple effects. These analyses indicate that neither the difference in satisfaction for the group that went from Incomplete to Complete was significant.

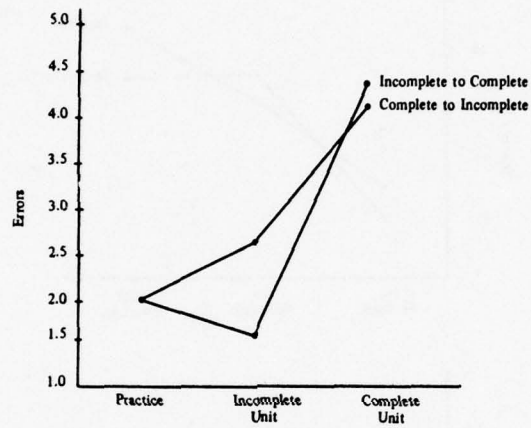
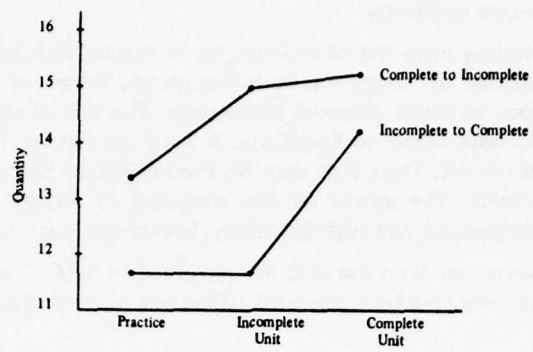


Figure 5. Complete-Incomplete unit: Performance.

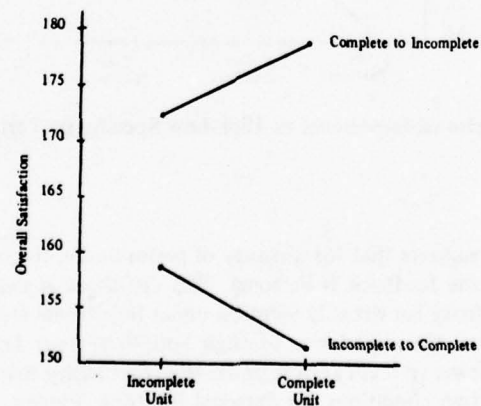


Figure 6. Complete-Incomplete unit satisfaction.

Personal-Impersonal vs. High-Low Specificity

We now turn to the second major set of analyses, those dealing with interactions of some of the manipulated variables. Recall that the design was such that specific subsets of the manipulated variables were crossed with each other to detect potential interactions. The first of these was a comparison of Personal-Impersonal feedback with High-Low Specificity. A 3 x 2 analysis was done for this comparison, with cells 1A, 1B, and 1C as one set. These cells were No Feedback; Low Specificity, Personal; and High Specificity, Personal, respectively. The second set was composed of 2A, 2B, and 2C which were No Feedback; Low Specificity, Impersonal; and High Specificity, Impersonal, respectively.

Means and standard deviations for these cells are presented in Table 2 and Figure 7. We shall not discuss the main effects since these have been presented earlier, but rather we shall focus on the differential effects.

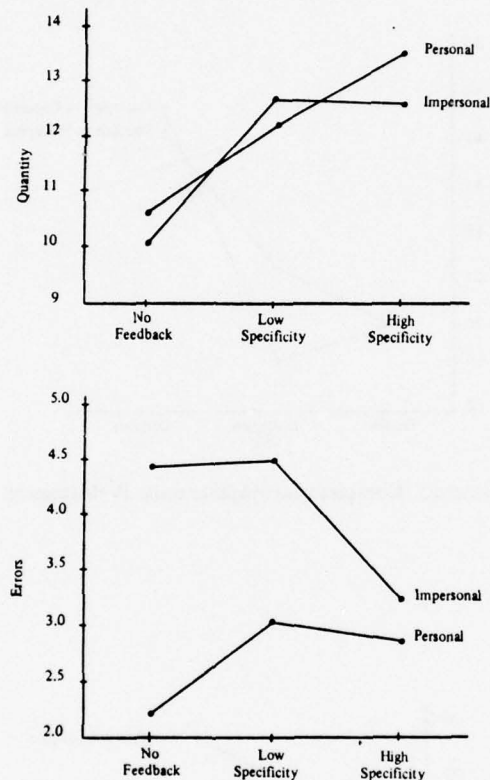


Figure 7. Personal-Impersonal vs. High-Low Specificity: Performance.

Inspection of the means suggests that for quantity of performance, the superiority of High over Low Specificity is true only when the feedback is Personal. This difference is significant ($p < .05$) while the means for High and Low Specificity are virtually identical under Impersonal feedback. The opposite is true, however, for errors. In this case, the superiority of High Specificity over Low Specificity is due to the Impersonal feedback showing fewer ($p < .01$) errors under High Specificity than under Low Specificity. No differences exist between the two conditions for Personal feedback. Finally, no differential effects were found in the job satisfaction analyses as evidenced by a non-significant interaction ($p < .33$).

Personal-Impersonal vs. Public-Private

In this 3 x 2 analysis, the first set of cells were 1A, 1C, and 1D which consisted of No Feedback; Personal, Private; and Personal, Public respectively. The second set were 2A, 2C, and 2D: No Feedback; Impersonal, Private; and Impersonal, Public, respectively.

These means are presented in Figure 8. The analysis indicates that no differential effects are operating. For quantity this is reflected by the fact that the means for Public and Private are equal for the Personal group as well as for the Impersonal group. In the error data the same situation exists. Although the figure shows errors to be lower under Public than under Private for the Personal feedback, this difference is not significant ($p < .25$). Finally, no differential satisfaction effects were obtained ($p < .10$).

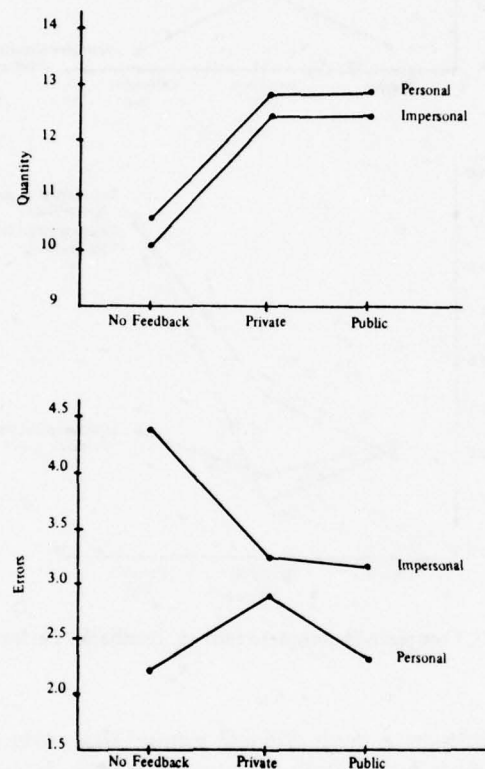


Figure 8. Personal-Impersonal vs. Public-Private: Performance.

Complete-Incomplete Unit vs. Feedback

The last interaction analysis compares the Complete and Incomplete Unit analyses with and without feedback. A 3 x 3 analysis was used here with cells 3A, 3B, and 3C; 4A, 4B, and 4C; and 5A, 5B, and 5C. The means for these cells are shown in Figure 9. As before, the Complete-Incomplete cells are displayed out of temporal order for purposes of clarity. Also as before, our focus here is not on the main effects, but rather the effects of adding feedback to the Complete-Incomplete interpretations. Inspection of the means in Figure 9 suggests that adding feedback does have an effect on the Complete-Incomplete interpretations. The quantity data suggest that, without feedback, Complete is superior to Incomplete. However, when feedback is added, this superiority is not present in that the quantity is actually lower under Complete than Incomplete when feedback is given. However, this difference is not significant ($p < .15$).

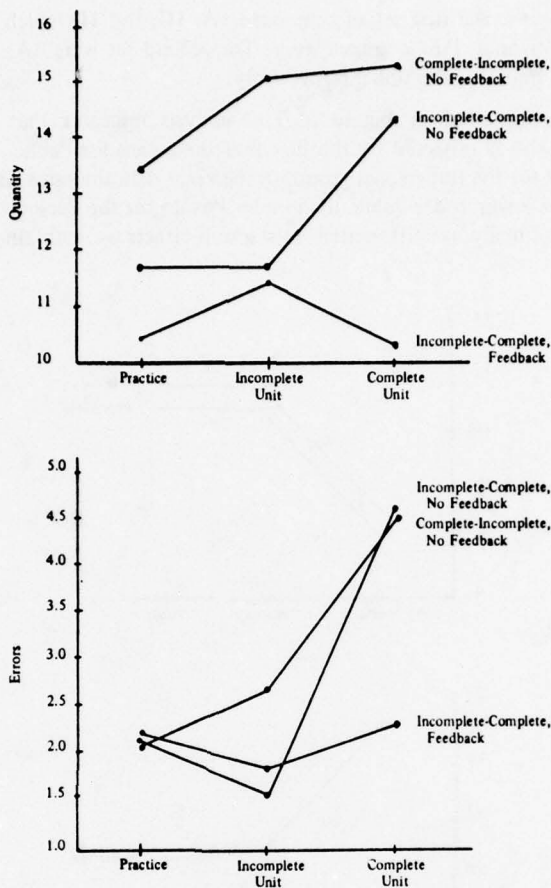


Figure 9. Complete-Incomplete unit vs. feedback: Performance.

The error data, however, show a much different picture. Here, when feedback is not given, the Complete version resulted in much higher errors than the Incomplete. In contrast, when feedback was given, there was no difference in errors between Complete and Incomplete ($p < .50$).

Finally, the satisfaction data showed no differential effects.

Summary of the Results

The foregoing results may be summarized as follows:

- 1a. Both Personal and Impersonal feedbacks had a positive influence on quantity of performance. The mean percentage increase over No Feedback was 23%. There were no differences in effectiveness between Personal and Impersonal on quantity.
- 1b. There was a tendency for Impersonal feedback to have a greater effect in decreasing errors than Personal Feedback. Impersonal feedback decreased errors 18%.
- 1c. There were no differences in overall job satisfaction between Impersonal and Personal feedback.
- 1d. Overall, Impersonal feedback was superior to Personal feedback.

2a. Both High and Low Specificity feedbacks when given in the Individual format were superior to No Feedback for the quantity variable. The overall increase in quantity was 23%.

2b. There was a tendency for High Specificity to result in higher quantity (4%) than Low Specificity.

2c. High Specificity resulted in fewer (23%) errors than Low Specificity.

2d. The same pattern of results emerged when the High and Low Specificity feedbacks were provided on the Group basis, but the differences were not significant.

2e. There were no differences in overall job satisfaction between High and Low Specificity for either Individual or Group formats.

2f. There was some evidence of interactions between High-Low Specificity and Personal-Impersonal feedbacks. For quantity, High was superior to Low Specificity when the feedback was Personal, but not different when the feedback was Impersonal. The reverse was true for errors in that High was better than Low Specificity when the feedback was Impersonal but they were not different when the feedback was Personal.

2g. Overall, High Specificity feedback was superior to Low Specificity, when the feedback was given on an individual basis.

3a. In the Delayed-Immediate analyses, the overall effect of feedback was to decrease quantity (10% decrease), and improve the error rate (19% improvement).

3b. In general, Delayed feedback was superior to Immediate feedback in quantity (10% higher) and error rate (22% better). However, most of the superiority of Delayed feedback was due to the Long Delay rather than the Short Delay conditions.

3c. There were no differences in overall job satisfaction for Delayed or Immediate feedback conditions.

3d. Overall, these results show Delayed feedback to be superior to Immediate feedback, especially when the delay was longer.

4a. There were no overall differences in quantity or errors when comparing Group to Individual feedback.

4b. There was some evidence that Group was superior to Individual for errors when the feedback was High Specificity.

4c. There were no differences in overall job satisfaction between Individual and Group feedback.

4d. Overall, the results indicated no clear-cut differences between Individual or Group feedback.

5a. When Public was compared to Private feedback, there were no differences in quantity, errors, or overall job satisfaction.

6a. Quantity was higher (9%) under the Complete Unit than under the Incomplete Unit. However, the superiority was due to the group that started under Incomplete and went to Complete. The group under the reverse pattern did not show Complete superior to Incomplete.

6b. Errors were much higher (107%) under the Complete Unit than under the Incomplete.

6c. When feedback was added, there were no differences in quantity or errors between the Complete and Incomplete Unit.

6d. There were no interpretable differences in overall job satisfaction.

IV. DISCUSSION

With the basic results presented, we now turn to the issue of interpreting these results. We shall discuss each of the experimental manipulations in turn, and then present some overall discussion of the findings.

The Personal Evaluative vs. Impersonal, Nonevaluative manipulation essentially showed that Impersonal was superior to Personal feedback, although both types of feedback had positive effects on performance. This is a particularly interesting finding, especially in light of the practices of most organizations. In most settings the supervisor is seen as the primary source of feedback. However, almost by definition, when the supervisor gives feedback to a subordinate, the feedback is evaluative and personal. Our findings suggest that other less personal and evaluative sources of feedback may be as effective or even more so. Clearly, the results suggest that such forms of feedback should at least be explored in further research.

The High vs. Low Specificity results are fairly clear-cut. Both forms of feedback were effective, but the high Specificity feedback was clearly superior to Low Specificity. The major mechanism included here is providing information to workers in a form that allows them to change their behavior. Gross feedback on quality and quantity of performance indeed appears to have motivating properties, but more information is needed by the workers in order to know how to change their behavior to be more productive. This is a difficult issue in that it is hard to know exactly how much information to give. Too little does not show the person how to change his or her behavior, but too much information will presumably result in overload so that the worker may simply ignore it.

Two approaches seem possible to addressing this issue of the appropriate degree of specificity. One approach would be to examine the formal evaluation system. We are referring here to the way in which the formal evaluation system, typically in the form of the supervisor, evaluates performance. Specifically, one could identify those products the worker produces that are actually used by the supervisor in his or her evaluation. These could then serve as guidelines for the degree of feedback specificity. The second approach is to ask the job incumbents what they feel would be the best level of specificity. Presumably, both strategies could be employed.

The Delayed-Immediate results showed some surprising findings. The general result was that Delayed feedback was superior to Immediate feedback. This contradicts the general feedback literature, and the prescriptive guidelines normally advocated for performance feedback. However, the results must be viewed in context. Even the Long Delay feedback condition was only five workdays. Getting feedback this quickly after performance in many actual organizations is relatively rare. Thus, even our Delayed feedback could be seen as fairly immediate when the possibilities in actual organizations are considered.

Another issue pertinent to the explanation of these results is the possibly perceived coercive nature of the feedback. It is possible that the Immediate feedback was seen by the subjects as an attempt to coerce them to higher levels of performance. If this were the case, it would help explain why Delayed was superior to Immediate. If the subjects felt the feedback was coercive, then giving feedback about performance which occurred several days before may have lessened the perceived coercive nature of the feedback.

Regardless of the possible explanation of the findings, it must be stressed that these results are tentative. Considering previous research and the fact that even under the Delayed conditions feedback actually occurred fairly soon after performance, it would be inappropriate to conclude that feedback should be delayed in an actual organization.

The overall results of the Group vs. Individual feedback showed essentially no differences in the two conditions. It is possible that the argument about the coercive nature of the feedback may be appropriate here as well. Specifically, if the Individual feedback was seen as coercive, this perception may have lessened the positive impact of the feedback. If the Group feedback was not seen as being as coercive, it could have masked any real superiority of Individual feedback. Thus, if the coercive nature were somehow removed, Individual would be superior to Group. However, this argument is purely speculative at this point.

There appeared to be no positive or negative effects of making the feedback public. On the one hand, one might argue that Public feedback would have a positive effect in that social pressures or competition might increase productivity. On the other hand, Public feedback could be resented by some workers. In any event, we must be extremely cautious about generalizing these results to jobs in ongoing organizations where permanent jobs are involved.

The Complete-Incomplete Unit results were very interesting. The results suggest that great caution should be exercised in enlarging jobs. While quantity was higher, the error rate went up dramatically. The addition of feedback helped keep the error rate down, but there was no evidence that, when both quantity and errors were considered, Complete was superior to Incomplete.

These results suggest that job redesign is a very complex process indeed. As was indicated in the literature review discussion, the results of job redesign studies are very conflicting. The results suggest that, for job redesign to be successful, more is needed than just enlarging the job, even when feedback is added.

When we look at the results of the study as a whole, several points emerge. Feedback certainly appeared to have great potential for improving productivity. However, different types of feedback have markedly different effects. This brings up the issue of which types of feedback appeared to work the best, and the answer is fairly straightforward. If we examine the results of the various feedback combinations, the best type of feedback in this study was Impersonal, High Specificity, Individual feedback in either the Public or Private format. This combination of feedback resulted in a 26% increase in quantity and a 27% decrease in errors.

Clearly, such effects are very meaningful. If effects of anywhere near this magnitude could be obtained in controlled field settings, feedback would definitely take a premiere place in the tools that could be used to enhance productivity.

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APPENDIX A: PURCHASING REQUISITION

PURCHASING REQUISITION Form 12 Rev. 1976																								
INSTRUCTIONS - INCLUDE IN EACH REQUISITION ONLY SUCH ARTICLES AS MAY BE PURCHASED FROM ONE FIRM. GIVE EXPLANATION IF SPECIAL HANDLING IS DESIRED. If this is a Physical Plant Order, submit two copies.																								
DEPARTMENT COMPLETES UNSHADED AREA					PURCHASING COMPLETES SHADED AREA																			
DEPT. OR FUNCTION JANITORIAL					ORDER DATE		ORDER NO.																	
RES. CODE	DEPT. REF.	ACCOUNT NO.	DET. CLASS	AMOUNT	FOLLOW-UP DATE		552																	
A		34-80231			VENDOR NO.																			
B					VENDOR																			
C																								
VENDOR SUGGESTED																								
GENERAL STORES																								
DELIVER TO STAFF MEMBER ROOM NO. BUILDING																								
REQUISITIONER'S PHONE NO.		MATERIAL WILL BE USED FOR:			FOB <input type="checkbox"/> PURDUE <input type="checkbox"/> SHIPPING POINT <input type="checkbox"/> PURDUE PREPAY & ADD <input type="checkbox"/> SHIPPING POINT FREIGHT ALLOWED																			
					TERMS <input type="checkbox"/> NET <input type="checkbox"/> REGULAR																			
					BUYER																			
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">QUANTITY</th> <th style="width: 20%;">ITEMS (GIVE FULL DESCRIPTION)</th> <th style="width: 10%;">Multiple Fund Code</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">30</td> <td>0-27-675002 Trap</td> <td></td> </tr> <tr> <td style="text-align: center;">20</td> <td>0-37-005555 Paper Toilet</td> <td></td> </tr> <tr> <td style="text-align: center;">125</td> <td>0-27-001015 Abrasives-Belt</td> <td></td> </tr> <tr> <td style="text-align: center;">12</td> <td>0-49-355584 Steel</td> <td></td> </tr> </tbody> </table>										QUANTITY	ITEMS (GIVE FULL DESCRIPTION)	Multiple Fund Code	30	0-27-675002 Trap		20	0-37-005555 Paper Toilet		125	0-27-001015 Abrasives-Belt		12	0-49-355584 Steel	
QUANTITY	ITEMS (GIVE FULL DESCRIPTION)	Multiple Fund Code																						
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20	0-37-005555 Paper Toilet																							
125	0-27-001015 Abrasives-Belt																							
12	0-49-355584 Steel																							
REQUESTED - HEAD OF DEPT.				DATE		APPROVED - FOR THE COMPTROLLER		DATE																
RECOMMENDED - DEAN OR ADMIN. OFFICER				DATE		APPROVED - FOR THE EXECUTIVE VICE PRESIDENT AND TREASURER		DATE																

APPENDIX B: GENERAL STORES INVENTORY STATUS

STOPEC20-1				CATEGORY - COMPUTER SUPPLIES		GENERAL STORES INVENTORY STATUS		04/02/76		PAGE 06		C1		OG NUMBER	
BEGINNING BALANCE	RECEIPTS	ISSUES	ADJUST- MENTS	ON HAND	MINIMUM BALANCE	ORDER QTY	DESCRIPTION								
1618	-7860	14154		5464	3000	1920	NATURAL UP LEFT								
71	120	125		62	70	120	NATURAL UP RIGHT								
71	60	67		64	50	120	RED STRIPE UP LEFT								
116	60	75		95	50	120	RED STRIPE UP RIGHT								
47		25		91	10	120	SOLUBLE UP LEFT								
193	360	226		200	120	120	SOLUBLE UP RIGHT								
				218			KNITTING R STRIP LEFT								
				55	50	120	KNITTING R STRIP RIGHT								
				618	1000	120	SYNTHETIC UP LEFT								
				100		120	SYNTHETIC UP RIGHT								
				100		120	1411-1-2-1-1 GR BAR								
				100		120	1411-1-2-1-1 GR BAR								
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				100		120	1411-1-2-1-1 GR BAR								

APPENDIX C: PURCHASE ORDER

PURCHASE ORDER

ORDER No.

THIS No. MUST APPEAR ON INVOICE, B/L, CASES, BUNDLES, PACKING LISTS AND CORRESPONDENCE

NAME OF COMPANY

STREET AND ADDRESS

CITY AND STATE

DATE _____

TO			QUOTATION INQUIRY No. TERMS MARK FOR			
SHIP TO			SHIPMENT F.O.B. FRT. ALLOWED VIA			
PLEASE SHIP THE FOLLOWING MERCHANDISE SUBJECT TO CONDITIONS BELOW: To insure prompt payment mail invoice showing order number and with bill of lading attached, to general office, immediately after shipment is made. Advise promptly if unable to make immediate shipment. Please advise receipt and acceptance of this order promptly. No charges allowed for boxing, crating or packing. Goods subject to our inspection on arrival, notwithstanding prior payment to obtain cash discount. Goods rejected on account of inferior quality or workmanship will be returned to you with charge for transportation both ways plus labor reloading, trucking, etc., and are not to be replaced except upon receipt of written instructions from us.						
QUANTITY	UNIT	STOCK NO.	DESCRIPTION	PRICE	UNIT	AMOUNT

PURCHASING AGENT

PER.

APPENDIX D: OUT OF STOCK FORM

ORDER # _____
TO : _____
Department

OUT OF STOCK

General Stores is temporarily out of the following materials you have requested:

ORD.	SHPD.	B.O.	DESCRIPTION

_____ PARTIAL SHIPMENT IS BEING MADE

Purchasing Clerk

APPENDIX E: PERFORMANCE SUMMARY

PERFORMANCE SUMMARY

NAME: _____ DATE WORK WAS DONE: _____

NUMBER OF PURCHASE REQUISITIONS FINISHED: _____

PERCENT OF PURCHASE REQUISITIONS

WITH ONE OR MORE ERRORS: _____

APPENDIX F: PERFORMANCE SUMMARY FORM FOR
IMPERSONAL-NONEVALUATIVE FEEDBACK

PERFORMANCE SUMMARY

NAME _____ DATE WORK WAS DONE: _____

NUMBER OF PURCHASE REQUISITIONS FINISHED: _____

PERCENT OF PURCHASE REQUISITIONS

WITH ONE OR MORE ERRORS: _____

QUANTITY	EVALUATION OF PERFORMANCE	<u>ERRORS</u>
<u>PROCESSED</u>		
EXCELLENT _____		ABOVE AVE _____
ABOVE AVERAGE _____		AVERAGE _____
AVERAGE _____		BELOW AVE _____
BELOW AVE _____		
POOR _____		

**APPENDIX G: PERFORMANCE SUMMARY FORM FOR
HIGH SPECIFICITY FEEDBACK**

PERFORMANCE SUMMARY: ERROR DISTRIBUTION

TYPE OF ERROR	NUMBER OF REQ. WITH THIS ERROR	PERCENT OF REQ. WITH THIS ERROR
Authorized Account #		
Item in Stock		
Re-Order Done		
Re-Order Correct		
B.O. Correct on P.R.		
B.O. Completed		
B.O. Correct		
Correct Deduction From Stock		
TOTAL		